

greenius

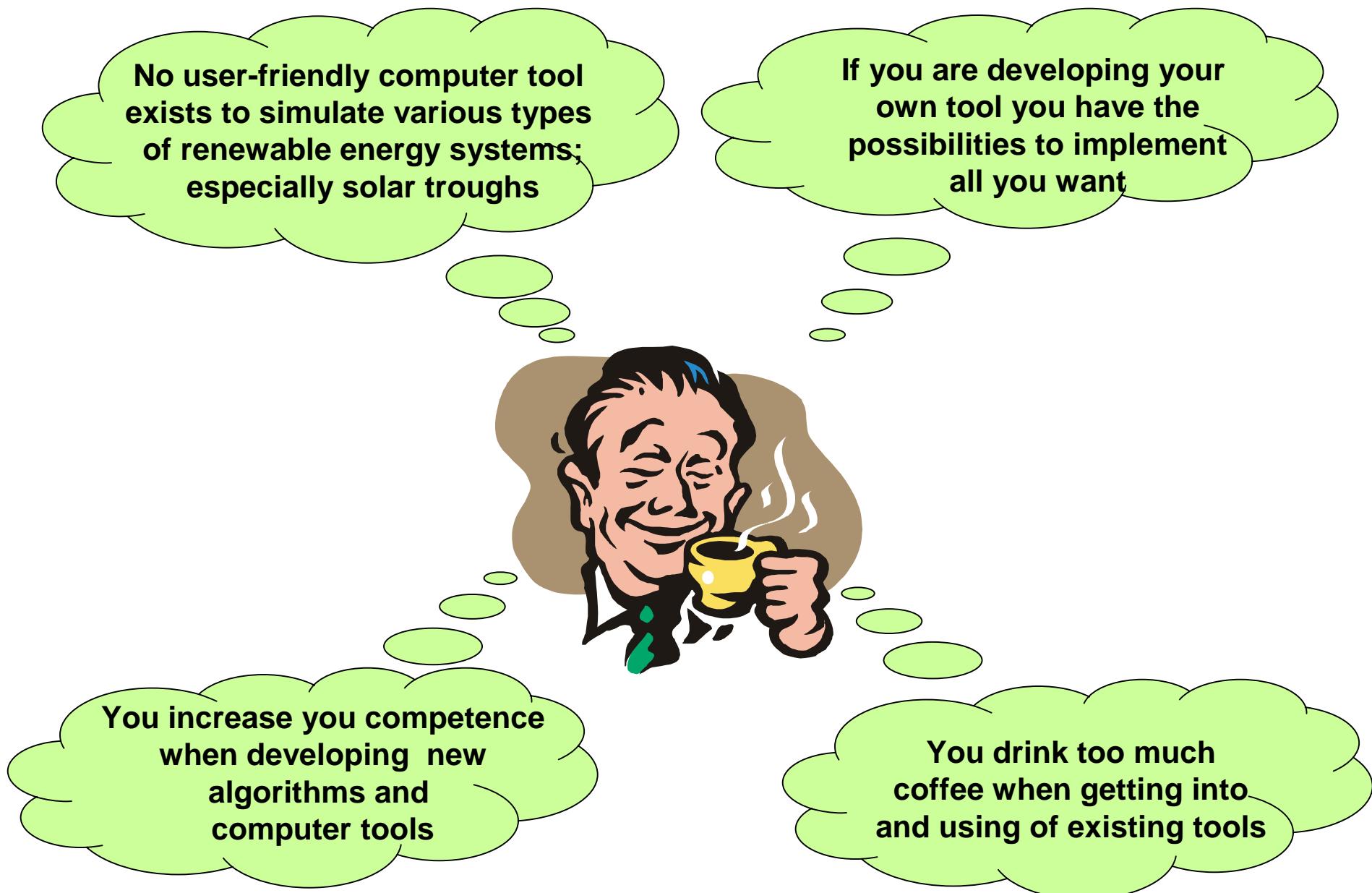
A New Simulation Environment for Technical
and Economical Analysis of Renewable Independent Power Projects

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Arguments for Developing a New Simulation Tool



Finding a Name for a New Computer Tool

green = green energy · clean energy · renewable energy

genius = innovative · new · fast · interesting



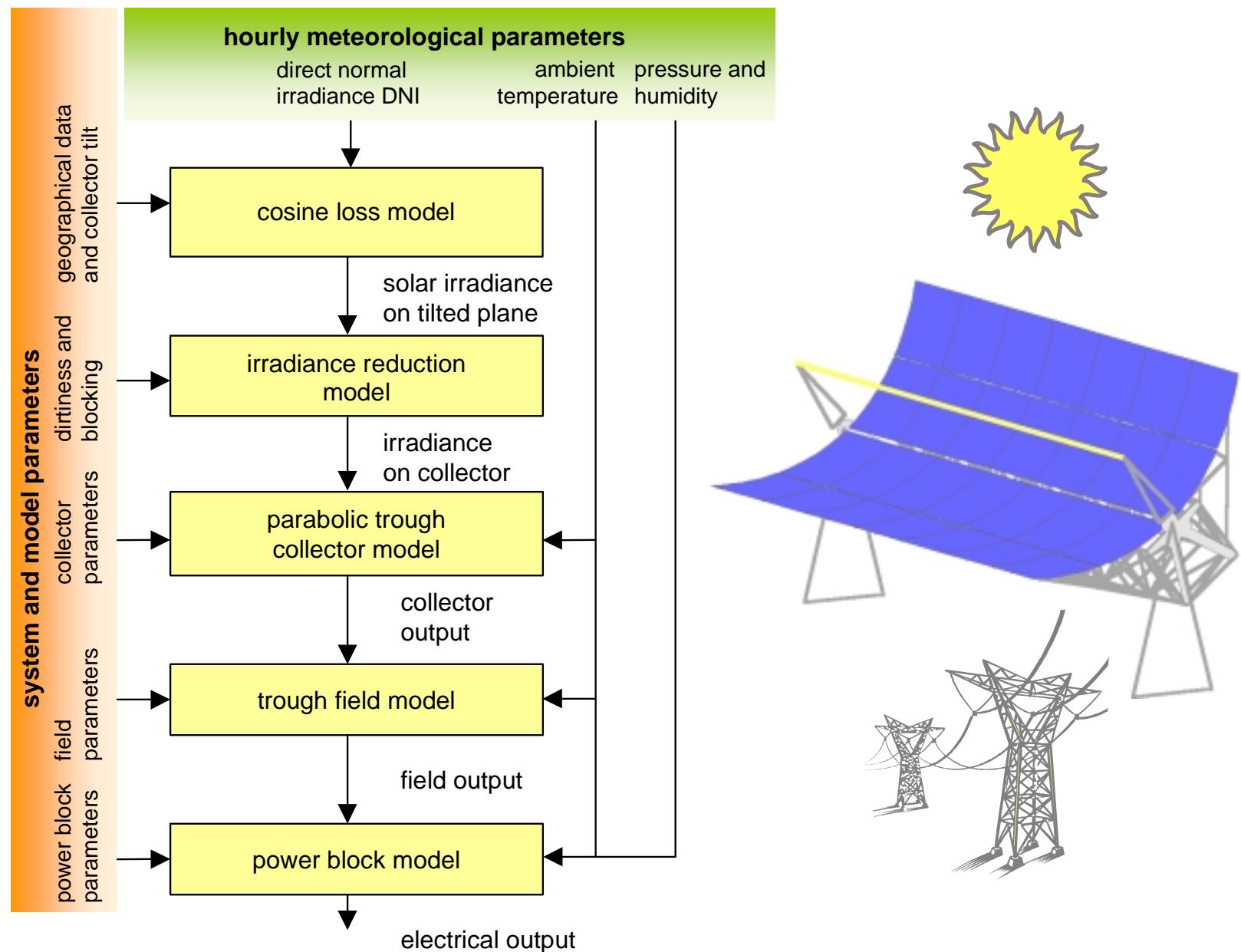
greenius
THE GREEN ENERGY SYSTEM ANALYSIS TOOL

Defining Requirements for the New Software



- ✓ Extensive technical and economical analysis
- ✓ High accurate simulation algorithms
- ✓ Extremely low calculation times
- ✓ User-friendly interfaces
- ✓ Comfortable data import and export modules
- ✓ High flexibility of input parameters

Modeling of Solar Trough Power Plants



LS-3

File Edit Tools Help

Trough Assembly



Simple Assembly Characteristics

General Information and Dimensions		Thermal Parameters	
Name	LS-3	Specific HCE mass	3.78 kg/m
Collector length	95.20 m	HCE heat capacity	0.136 Wh/(kgK)
Aperture width	5.76 m	Heat Loss Coefficients	
Effective mirror area	545.00 m ²	Coefficient b0	7.276E-5 /K
Focal length	2.12 m	Coefficient b1	0.00496 W/(m ² K)
HCE diameter	0.0655 m	Coefficient b2	0.000691 W/(m ² K ²)
Nom. optical efficiency	80.00 %		

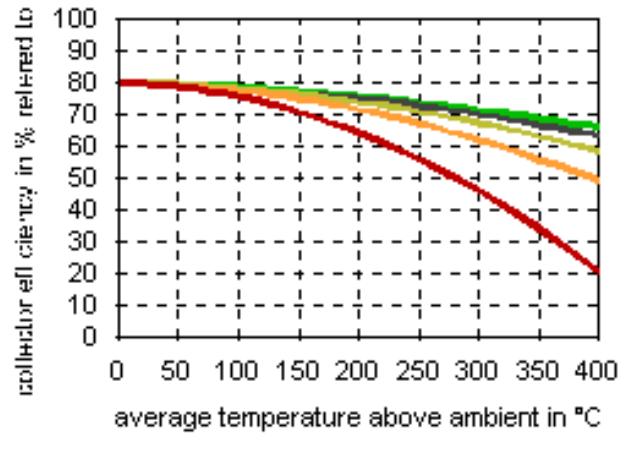
Incidence Angle Modifier

Coefficient a1	-0.000884 /°
Coefficient a2	5.369E-5 /(^°)

Graph Options

Angle of Incidence (for Graph) in °

0



collector efficiency in % referred to 100% at 0°C

average temperature above ambient in °C

— 200 W/m² — 600 W/m² — 1000 W/m²

— 400 W/m² — 800 W/m²

OK Apply Cancel

SEGS VI

File Edit Costs Help

Trough Collector Field



Field Data | **Field Operation**

General and Dimensions

Name	SEGS VI
Number of rows in the field	100
No. of collectors/row (half loop)	8
Field availability	98.5 %
Collector name	LS-2
Field size (effective mirror area)	188 '000 m ²
Nominal Thermal Output ¹	115 MWth
'DNI = 1000 W/m ² , amb. temp = 25 °C	

Fluid

type	VP 1	
Maximal fluid temp.	400 °C	
Minimal fluid temp.	15 °C	
Total mass	403.0 t	
density	heat cap.	temp.
kg/m ³	Wh/(kgK)	°C
999	0.4928	100
866	0.6078	250
689	0.7189	400

Pipes

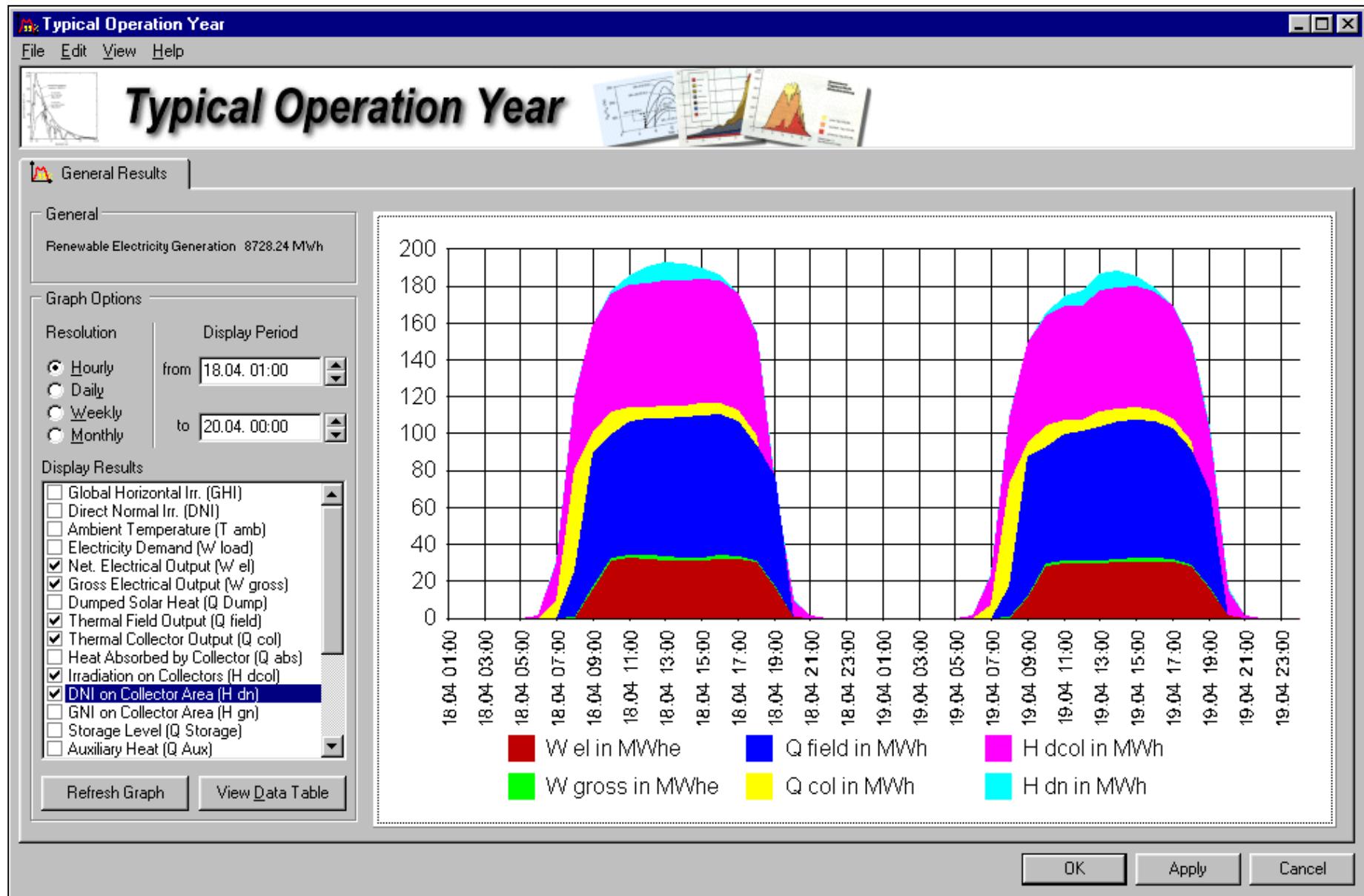
Total header length	2 956. m
Mean header diameter	0.2200 m
Header specific mass	65.00 kg/m
Pipe length in loops	4 925. m
Pipe diameter in loops	0.0508 m
Pipe specific mass	6.00 kg/m
Heat capacity ²	0.136 Wh/(kgK)
Piping losses ^{2,3}	0.0583 W/(m ² K)
Expansion vessel losses	9 345. W/K

Orientation

Distance between rows	14.93 m	Tracking axis tilt angle	0.00 °
Distance between collectors	0.50 m	Tracking axis azimuth	0.00 °
North-South			
<input checked="" type="checkbox"/> End gain possible			

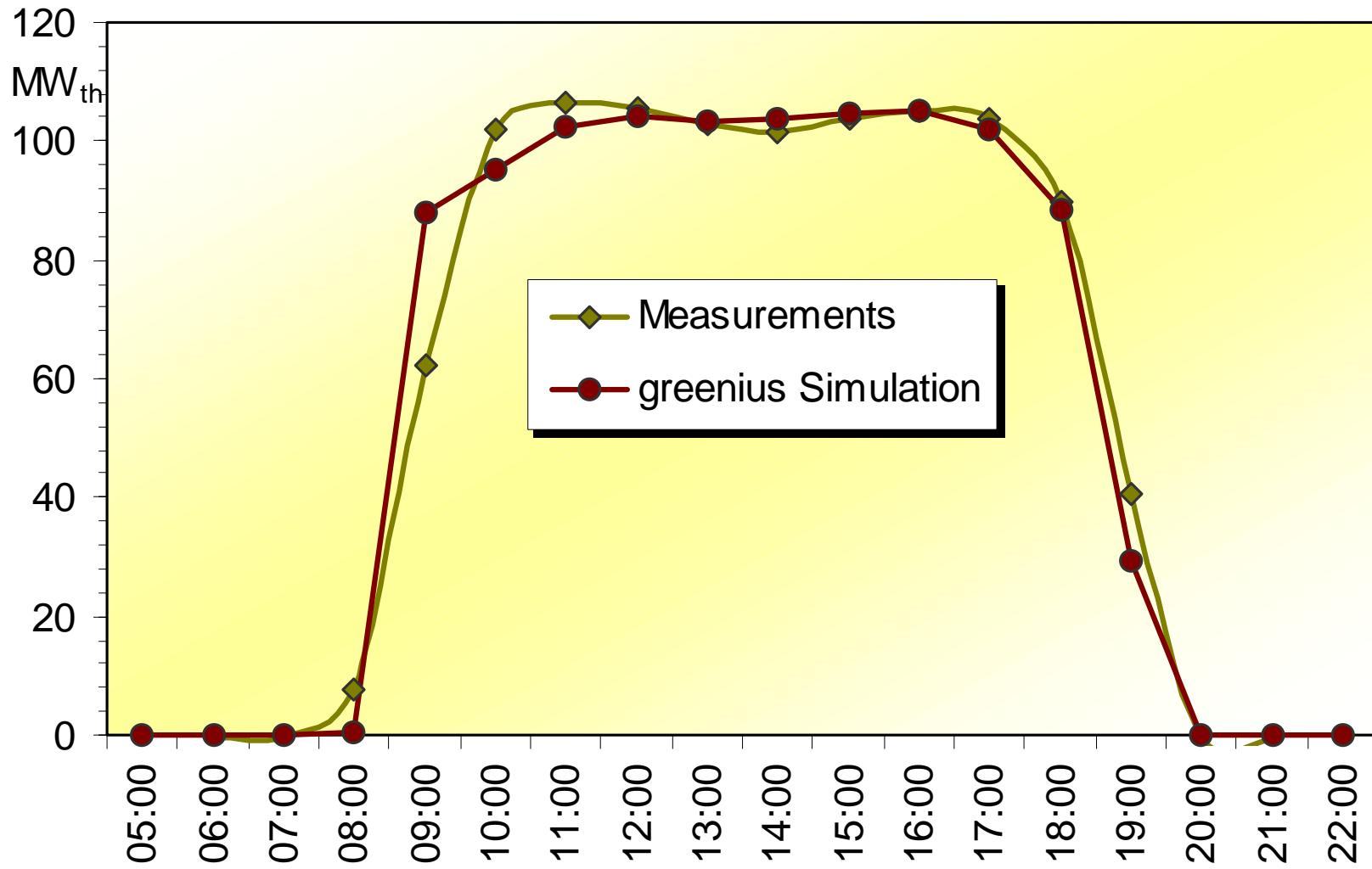
Buttons

- OK
- Apply
- Cancel



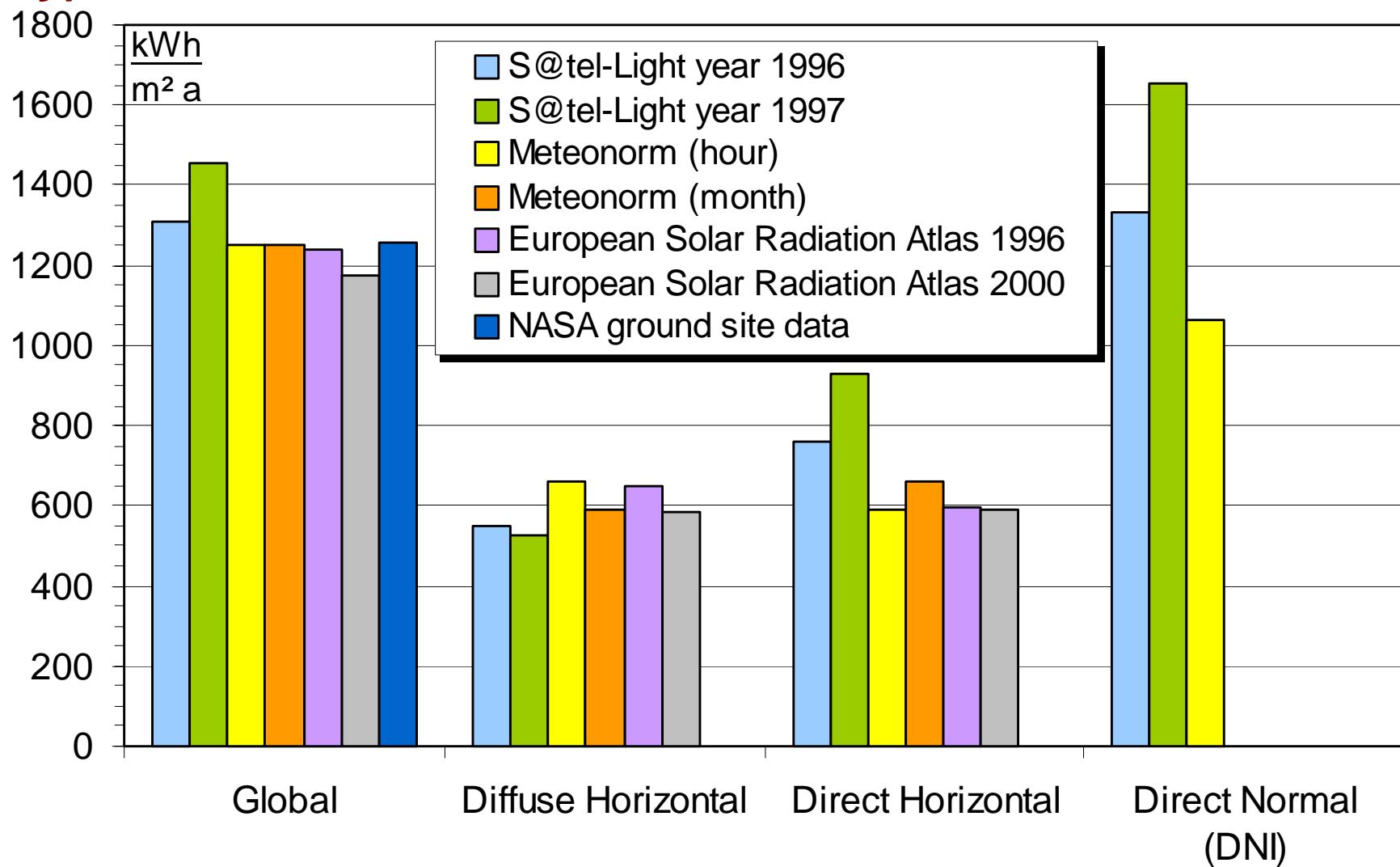
Verification of the Simulation Algorithms

Hourly thermal field output of SEGS VI (one day in April)

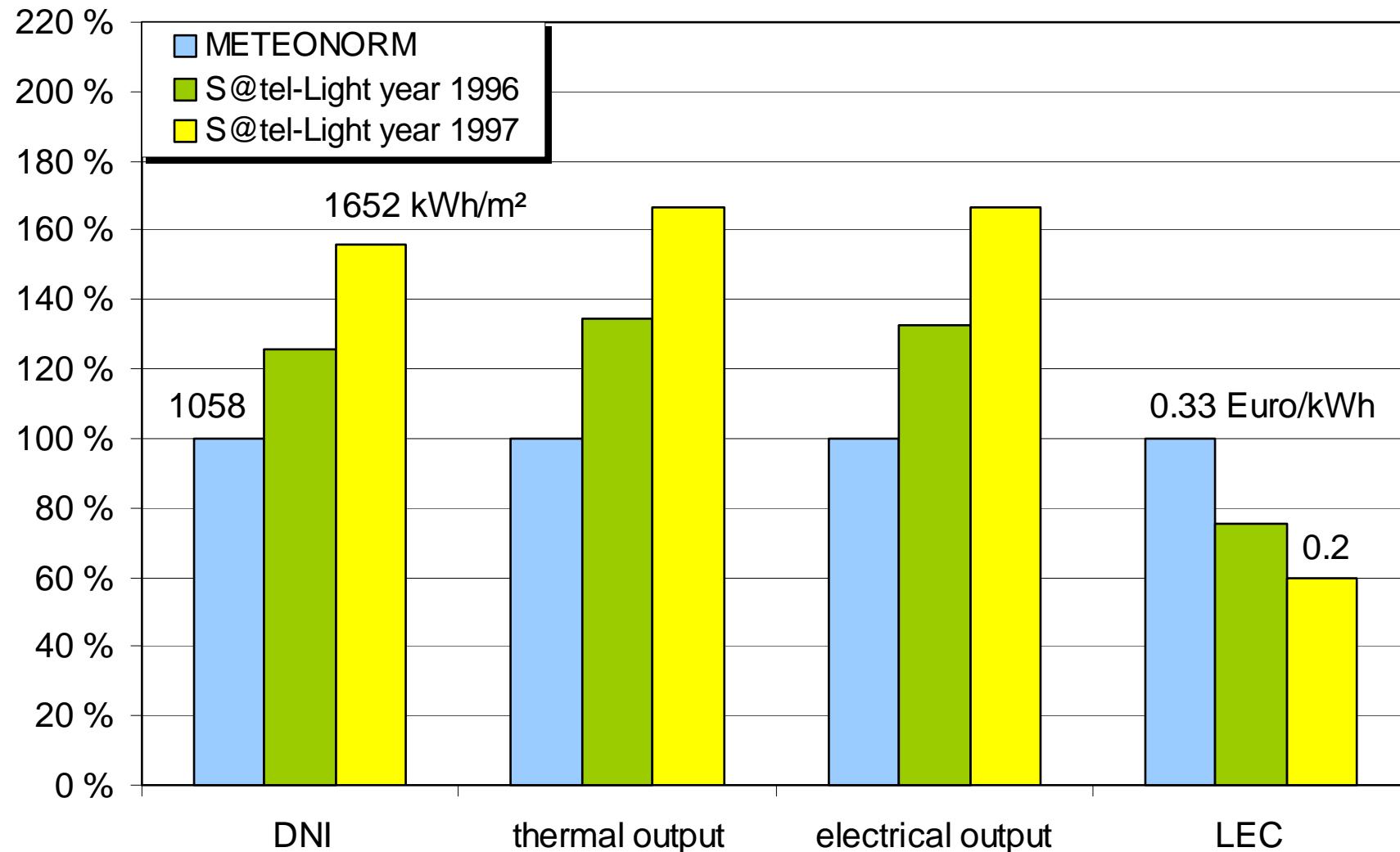


Choosing Solar Radiation - e.g. Sources for Milan

(Italy)



Results for Different Irradiation Sources



Other Implemented Renewable Technologies



Dish/Stirling Systems



Photovoltaic Systems

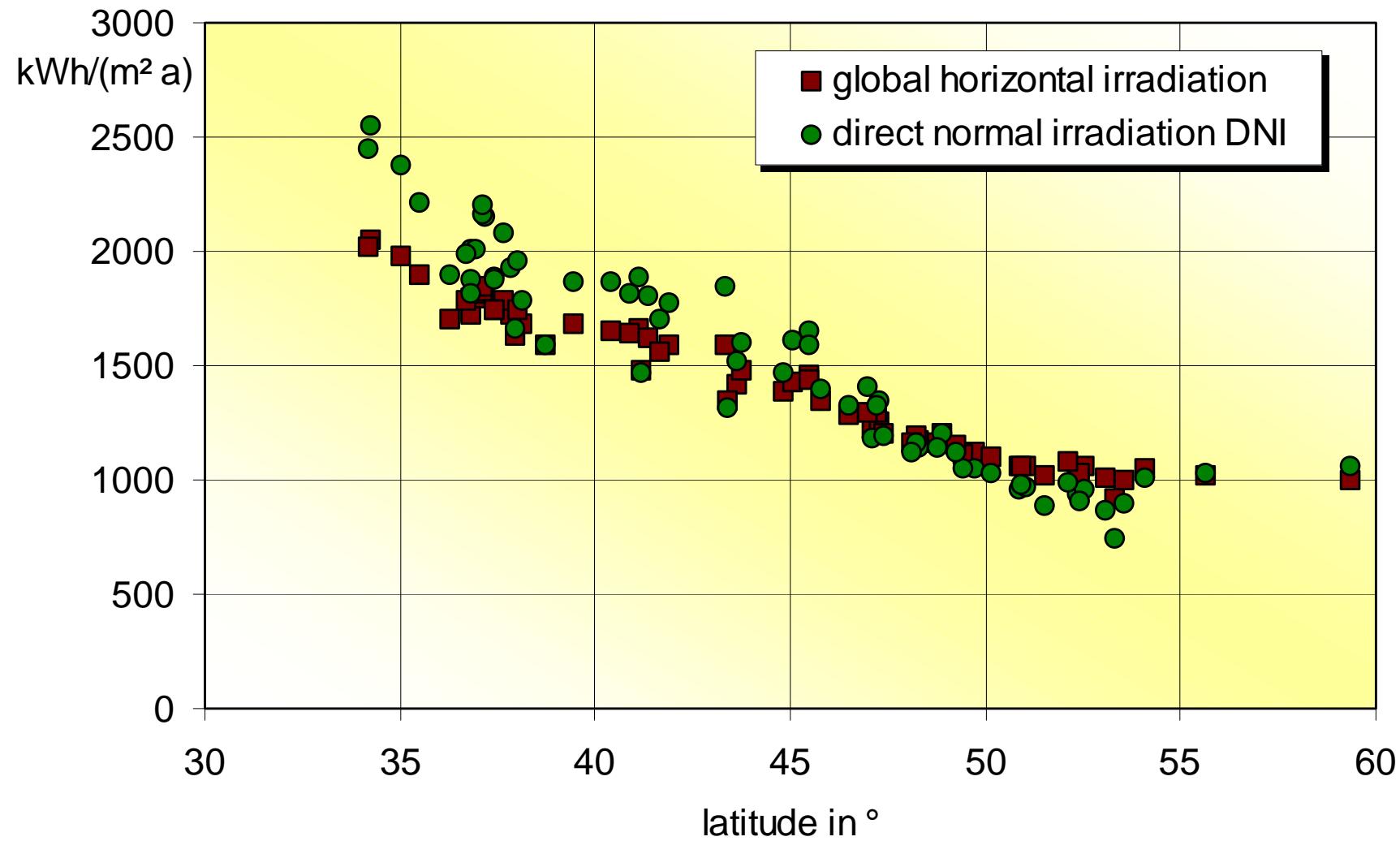


Wind Power Plants

Photovoltaics vs. Trough Power Plants



Irradiation in Europe and Northern Africa



Cost Comparison of PV and CSTP

